Advanced Technologies for Parking Management

Smart Parking

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Advanced Technologies for Parking Management

– Examples from Europe –

Dirk Serwill
August 21, 2006

Smart Parking covers the following areas

- Information
- Guidance
- Payment
- Reservation
- Automatic parking facilities

User groups in parking management

- **People with *no or limited knowledge* about parking situation (e.g. tourists, visitors) need *basic information***
  - Location of parking facilities
  - Fees and equipment of facilities
  - Number of available parking spaces (real time!)
  - (individual) Guidance to parking facilities
- **People with *good knowledge* about parking situation (e.g. commuters, residents) need *specific information***
  - Number of available parking spaces (real time!)
  - Short term forecast for next hour
  - (individual) Guidance to alternative parking facilities

- Road Signs
- Variable Message Signs
- Internet
- Cell Phones
- PDA, Smart phones
- In-car (navigation) systems

Overview of services

- General parking information
- Number of available parking spaces (real time)
- Short term parking forecast
- Collective Guidance to parking facilities (with available spaces)

Standard in bigger European cities

- Individual route guidance to parking lots
- Guidance and services in parking garages
- Advanced parking payment
- Automatic parking facilities

Some applications in European cities

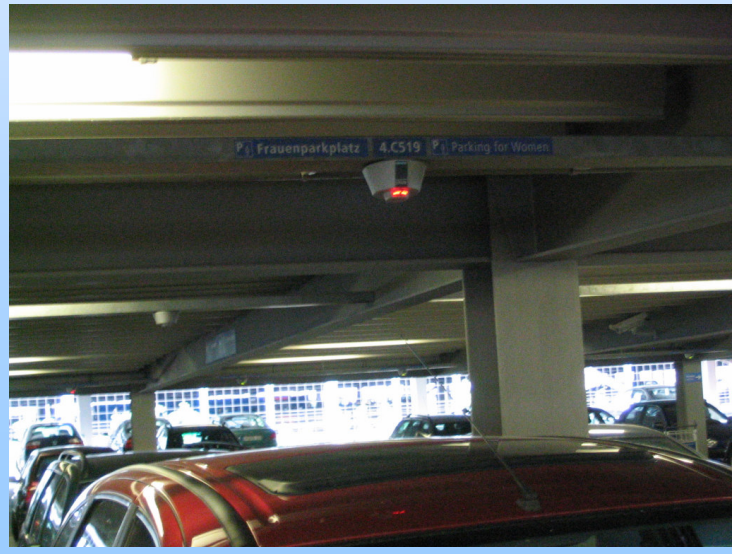
- Actual situation on-street parking (data from ticket machines)
- Individual parking reservations

Research and field trials

Ultrasound detectors determine stall occupancy:

- **Better guidance**
- **Improved attractiveness**
- **Better use of capacity**
- **Reduction of emissions**

Example Parking Garage Airport Cologne:



Internal Guidance – Determination of single space occupancy

Mostly used for multi-story parking facilities with high demand

Clients are informed about the vacant spaces on each floor before they enter the car park.

In the aisle the driver will find immediately even the last place.

General Parking Information - Location of facilities

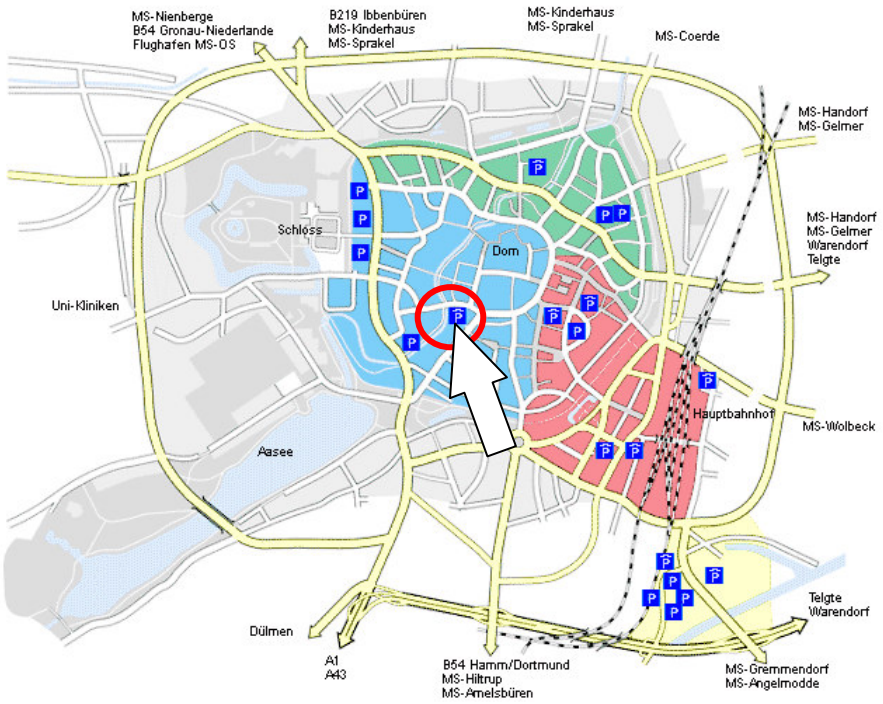
Tiefbauamt

STADT MÜNSTER

Das Parkleitsystem

Parkplatz/-haus	freie Plätze	Status
PH Theater	319	frei
PP Hörsterplatz 1	0	besetzt
PP Hörsterplatz 2	14	frei
Busparkplatz	0	geschlossen
PP Hindenburg Nord	304	frei
PP Hindenburg Süd	0	geschlossen
PH Aegidii	185	frei
PP G…skommende	0	geschlossen
PH Ka…dt	23	frei
PH Stub…asse	43	frei
PP Stubengasse	2	frei
PH Bremer Platz	184	frei
PH Engelenschanze	247	frei
PH Bahnhofstraße	126	frei
PH Cineplex	590	frei
PH Stadthaus 3	174	frei
PP Halle Münsterland Nord	128	frei
PP Halle Münsterland Süd	0	geschlossen
PP Halle Münsterland P4	0	geschlossen
PP Halle Münsterland P5	0	geschlossen

06.04.2006 11:33 Uhr



Für Detailinformationen zu den einzelnen Parkhäusern klicken Sie auf das jeweilige Symbol.

General Parking Information - Information per facility

http://www5.stadt-muenster.de - Parkhaus Aegidii - Mi...

Parkhaus Aegidii

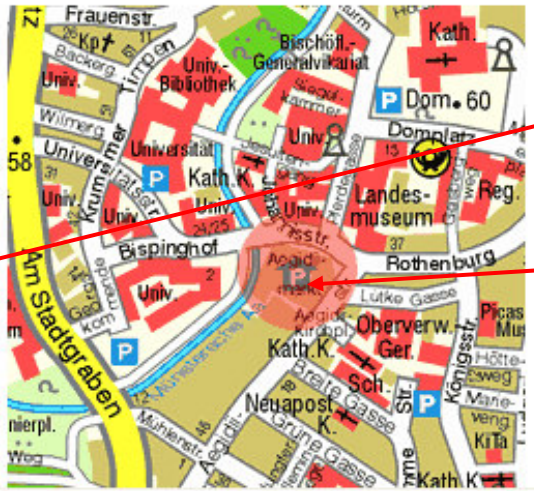
freie Plätze: **188** - gesamt: **780** - Stand: **06.04.2006 11:31 Uhr**

Öffnungszeiten: Mo - Sa 7 - 24 Uhr
So 9 - 19 Uhr
Adventssonntage 9 - 24 Uhr

Behindertenparkplätze: Ja

Behinderten-WC: Nein

Preise: Tagestarif:
jede angefangene Stunde 1 EUR
Tageshöchstsatz 10 EUR
Abendtarif: ab 19 Uhr pauschal 1 EUR



Fertig | Internet

Opening hours

Equipment (here: stalls for handicapped people)

Fees

Photo

Location

- **Reduction of search for parking traffic through effective guidance to (available) parking spaces**

Real time: Actual number of available spaces in area or lot

- **This (bad) example shows the variety of information:**

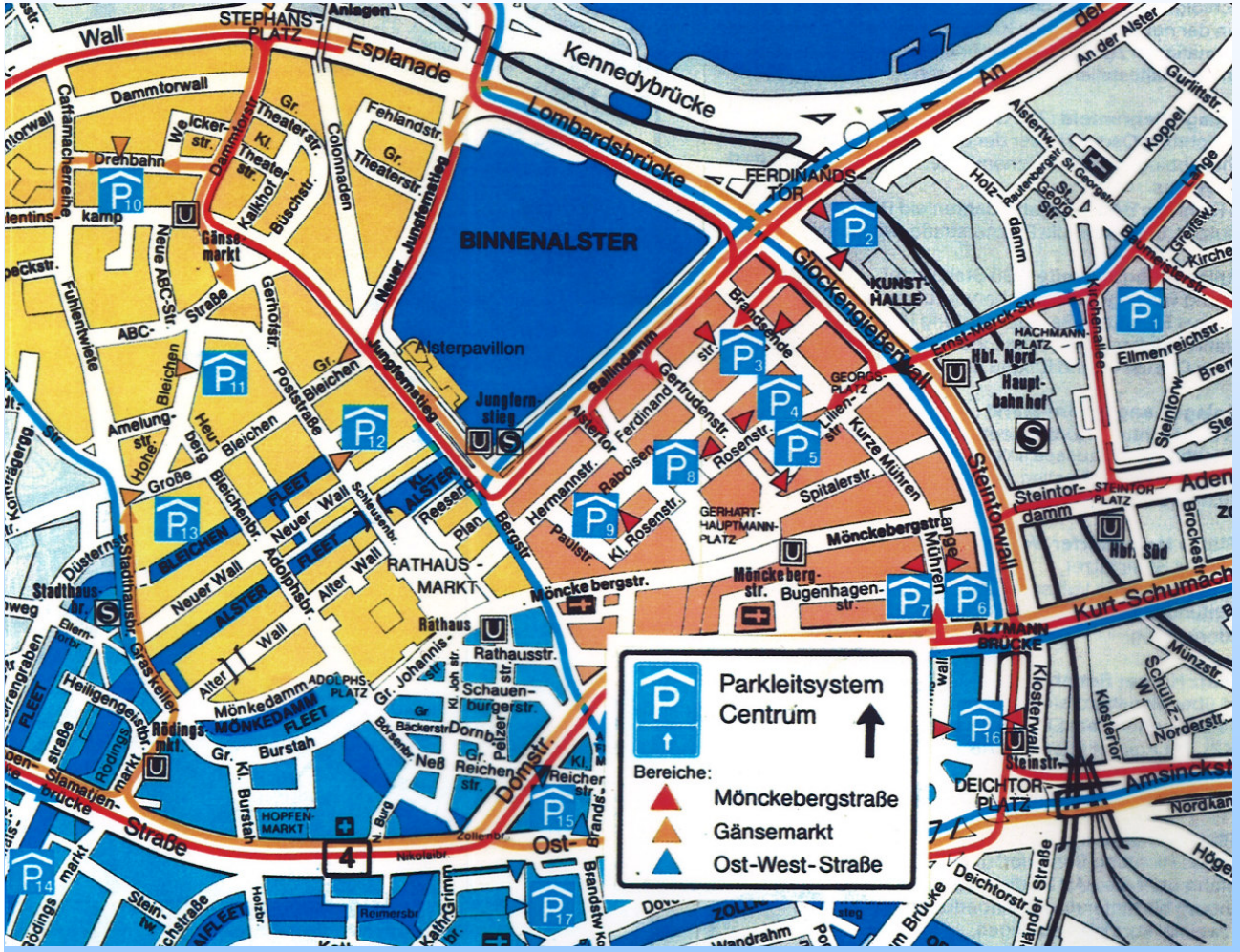
Garages and surface lots

Info for single lots and areas

Number of available spaces or info: full / vacant

Information for different user groups

- **Better orientation by using coloured areas (zones)**

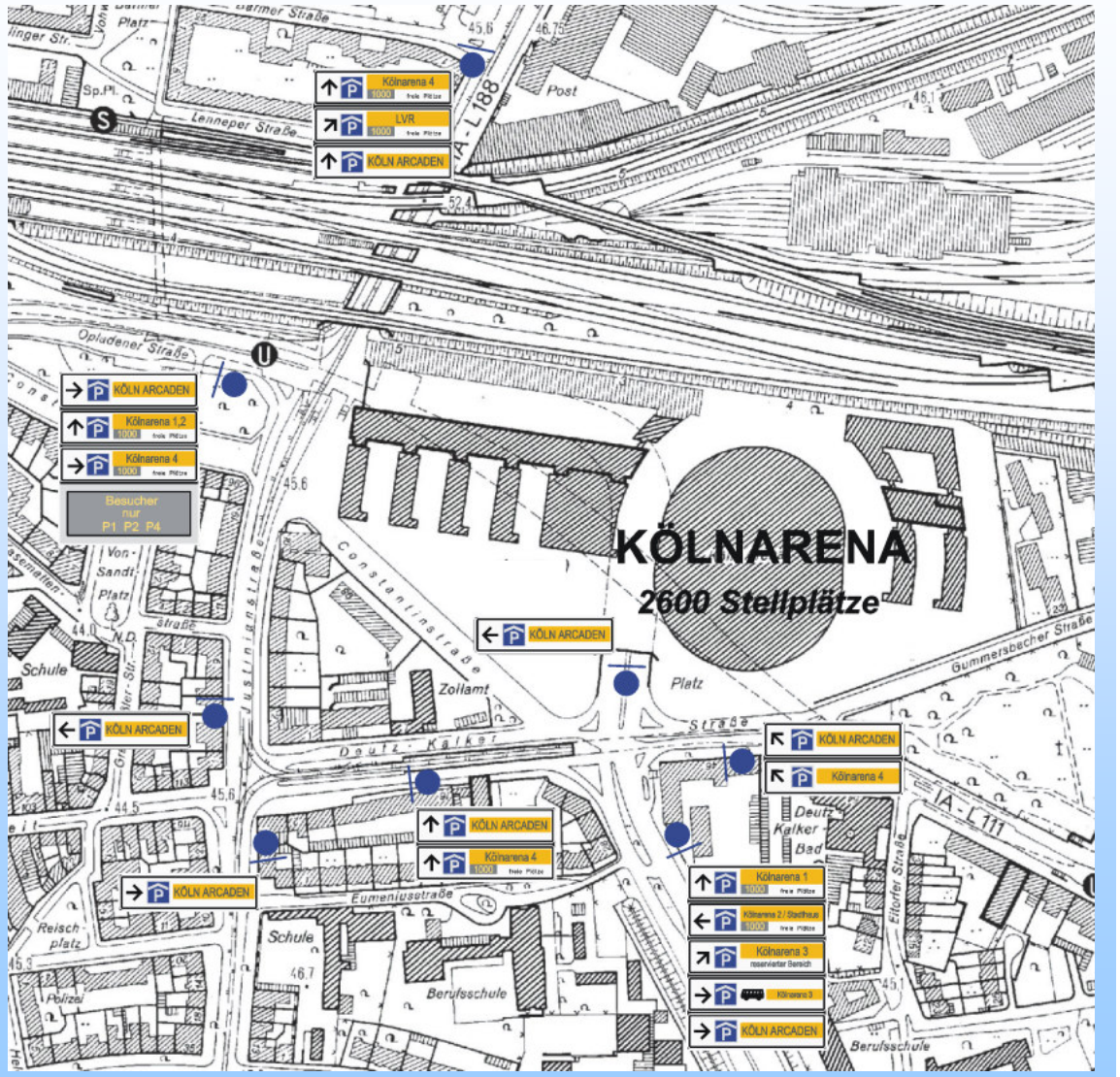


Guidance to single facilities

and (other) zones

Guidance to different facilities in one zone

- **Use of dynamic and static signs to guide**
  - to area
  - into area
  - to parking facility
- **Number of free spaces automatically delivered from parking facility (derived from payment procedure or counting devices)**



Actual number of available spaces in city center

Location of P+R Lot

Bus runs every x minutes

Bus travel time to city center

Here missing:
Actual number of available spaces at P+R Lot

Dynamic system since 1986. Today:

- 37 Garages (17000 spaces)
- 250 dynamic and 180 static signs

Results of surveys:

- 90% of car drivers know the system
- 75% have used it (figures from 1999)

Cost benefit analysis (year 2000):

- saved 9.4 million veh.-km for parking search
- reduced car traffic by 3.2 %
- saved 6.1 million Euros per year

First installation:

- **City: Owns the system and pays for central computers and road installations (signs, cables, …) - in Germany usually by using federal development funds (covering up to 80% of the costs)**
- **Garage owners: Pay for their in-house installations to provide data**

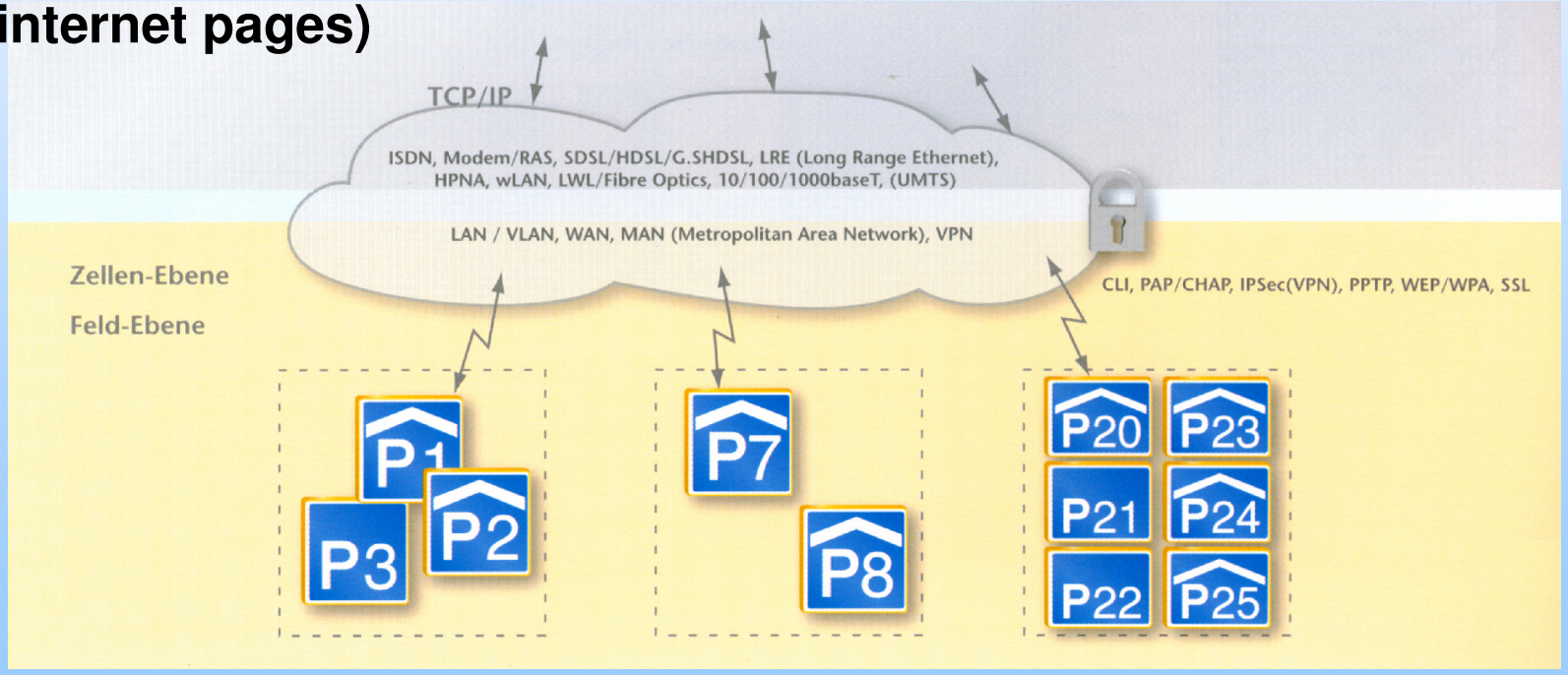
Operating costs:

- **Usually shared between city and garage owners**
- **Example Cologne: Fee is 3,000 € per year per garage (Small amount compared to the benefit of additional customers)**

Integration of a new facility in the system:

- **Garage owner pays for his costs + all necessary new signs, cables etc. in the system**

- **Perform short term forecast per parking facilities concerning available spaces**
  - Comparison of actual demand with "historic" demand
  - Perform trend extrapolations of input / output flows
- **Provide standardized data interfaces for external services (e.g. internet pages)**

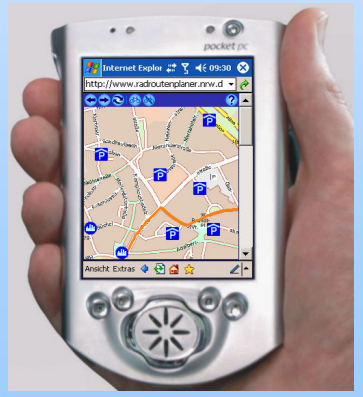


PGS data are the basis for information via advanced user interfaces

Cell Phone

In-car systems

Internet



PDA / Smartphone

Internet Information for PC and PDA

Location based parking information

- **Select parking garage from map**
- **Present nearest garages from destination address**

Full set of information per site

- **Actual number of available spaces**
- **Trend of occupation for next half hour**
- **Additional information: fees, opening hours, picture, .**

Route guidance from any location to parking lot

Park+Ride information including public transit lines and travel times to the city centre

Example: Internet Information for PC

Parkinfo Wuppertal - Microsoft Internet Explorer

Wuppertal

FENSTER SCHLIESSEN

Parkinfo Wuppertal

Barmen:	Zentrum	Zentrum Ost	Oper/Bahnhof
Elberfeld:	Zentrum	Johannisberg	Kluse

Informationen anzeigen für Quartiere

zurück zum Anfang

Parkinfo.NRW > Barmen > Zentrum

Barmen

Parken im Quartier Zentrum Barmen

Parkhaus/Parkplatz	freie P	Trend 15 min.	Auslastung in %	Ausstattung
Alter Markt	239		24	
Rathau	353		44	
Markt	91		64	
Lindenstraße	20		82	

short overview

Montag, 17.05.2004 - 18:17:19

sonstige Parkmöglichkeiten

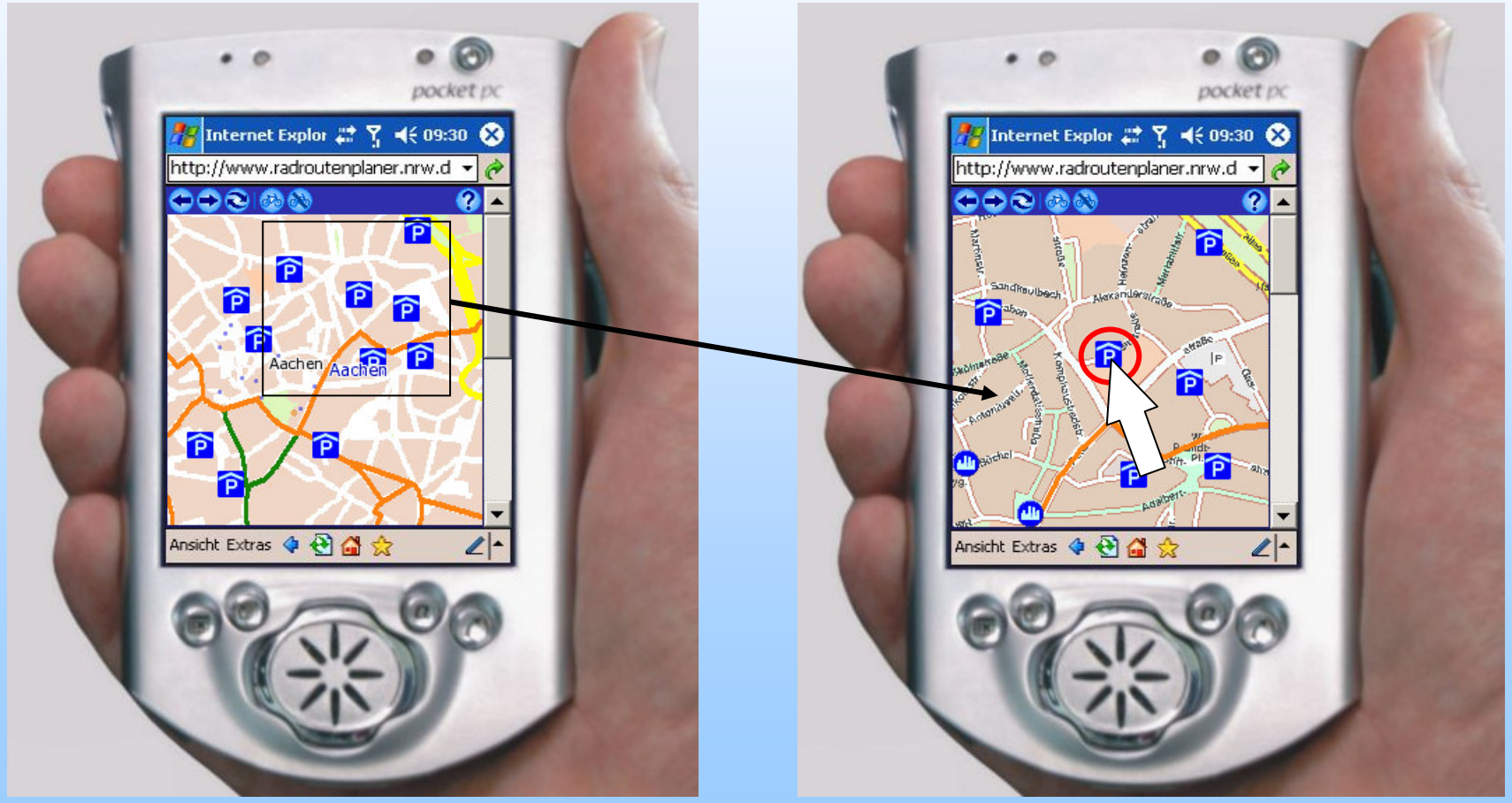
Parkhaus/Parkplatz	Kapazität			
	P			
Bleicherstraße	30	0	0	0
Paul Humburg Straße	34	0	0	0
Rolingswerth	22	0	0	0
St Etienne Ufer	31	0	0	0
Winklerstraße	15	0	0	0

Druckversion

Example: Internet Information for PC

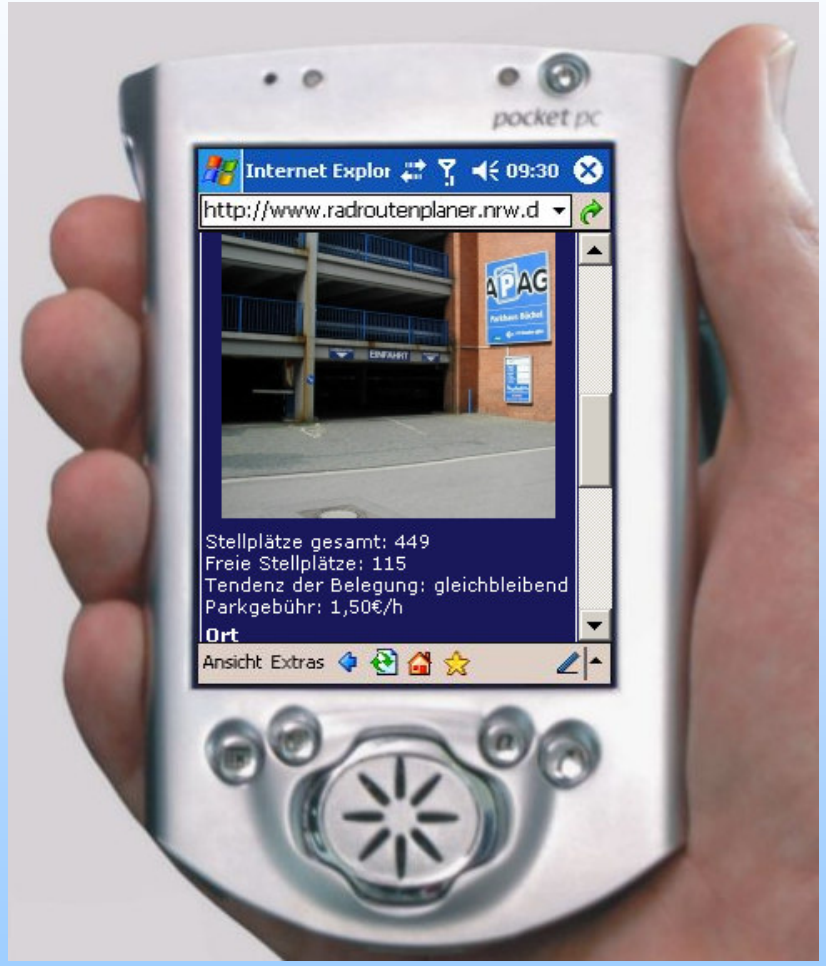
Example Internet Information PDA

Similar information on-trip via PDA or Smartphone – Location of Parking Facilities on a map

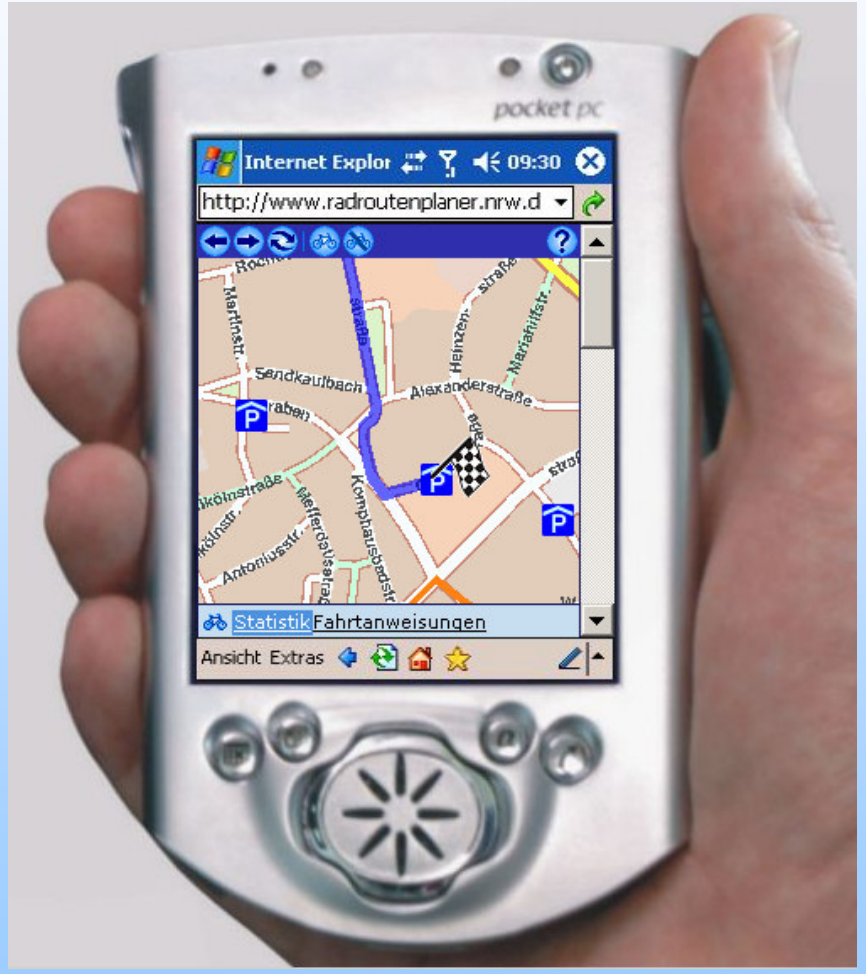


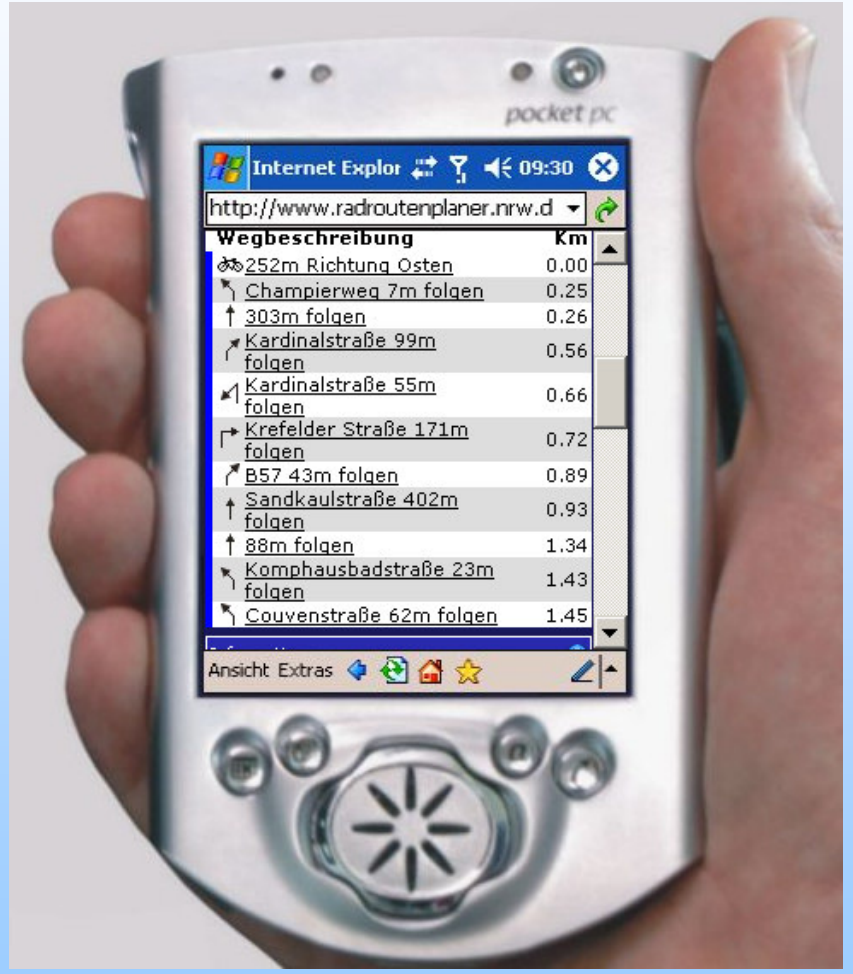
Example: Internet Information PDA

Information per site: Actual occupancy, trend, basic information, photo



Route guidance to parking facility

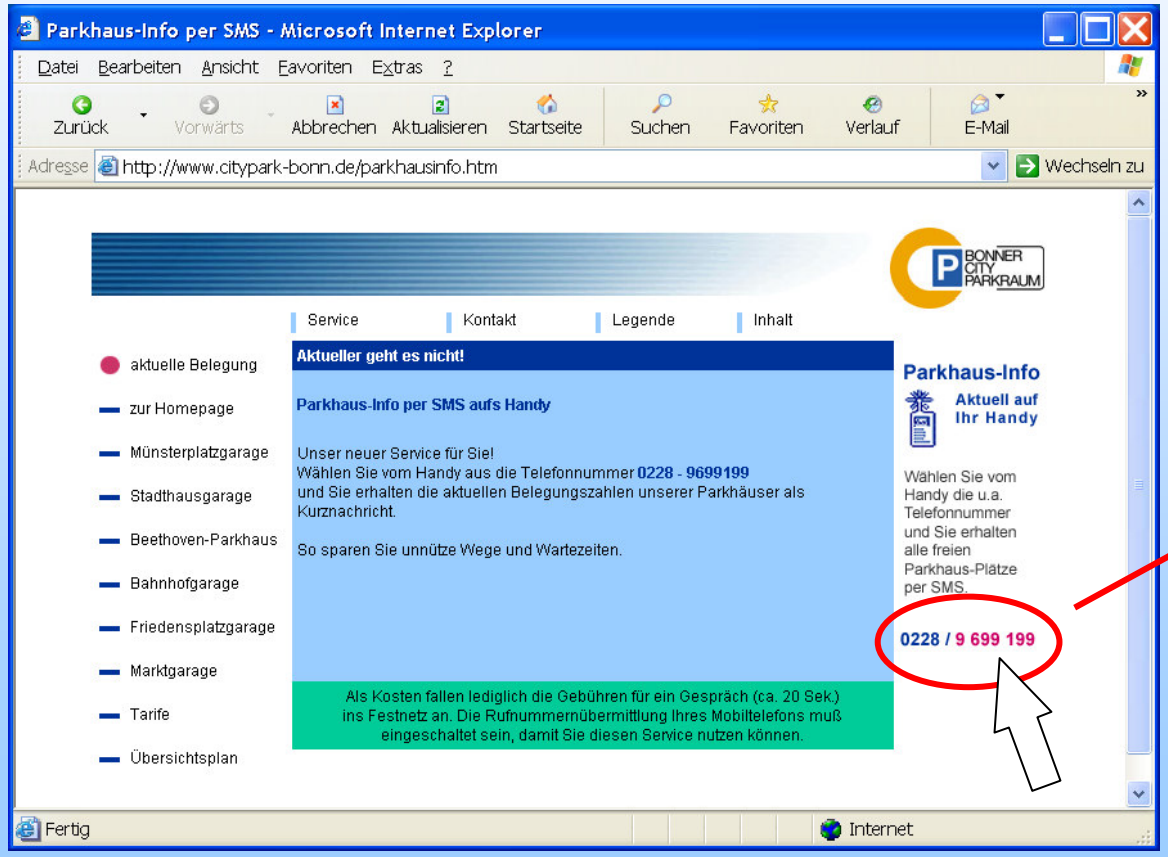


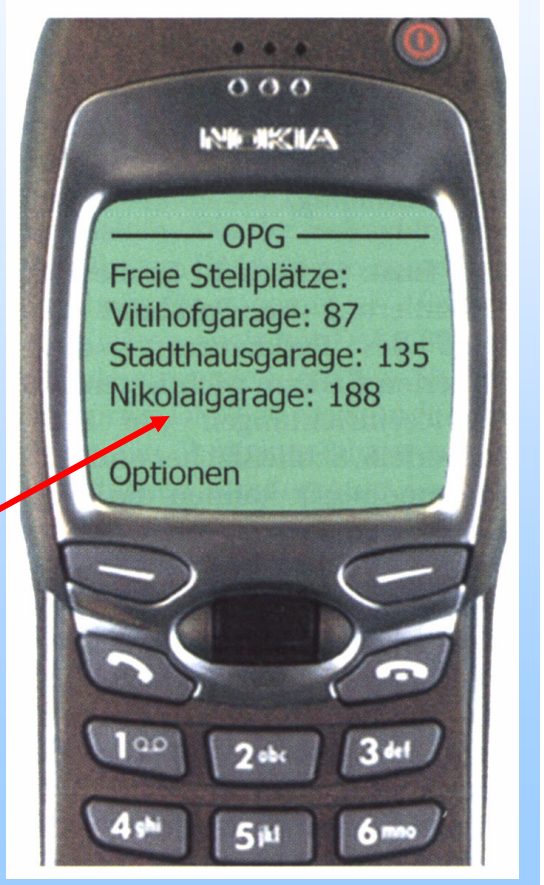


Example: Text Message on Cell Phone

- **Call a number or send a text message (SMS)**

  => Receive immediately the actual number of available spaces as a text message on your cell phone





Parking at ticket machines

- **Today's payment procedure:**
  - go to ticket machine
  - decide on parking duration
  - pay with coins (exact fare)
  - print ticket
  - return to car
  - put ticket on dashboard
- **Smart solution: Cell phone payment**
  - Registration for service
  - Call toll free or send SMS at beginning and end of parking
  - Fee will be calculated for the exact time used and debited from account
  - Parking enforcement officers check via PDA. If user "forgets" to check out, the maximum fee will be charged
  - No other installation necessary (like sensors on street etc.)

Prepaid Parking Payment by cell phone (e.g. for reservation)

- Register for service
- Reserve by internet or call toll free or send SMS
- Receive MMS with bar code
- Use cell phone display at bar code reader at parking entrance

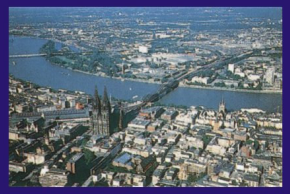
Example: Parking Management in the city of Cologne

Parking Guidance System
37 garages, 250 dynamic signs

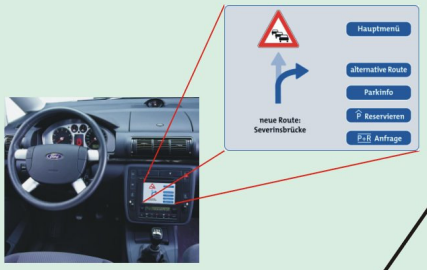
Reservation and Payment
Field trials:
reservation in a garage
and electronic payment
for on-street parking

Variable Message Boards
19 boards
with traffic and parking information

Parking Management in Cologne



In-Car-Systems
Guidance, P+R-Info, Reservation



Internet
Actual number
of free parking spaces
and forecasts

On-Street Parking Forecast
Actual occupancy and forecasts

Example: Parking Management in the city of Cologne

- **Parking Guidance System**
- **Parking Information on the internet**
- **Parking Information on variable message boards of traffic management system**
- **Cell phone payment at parking meters**

are standard applications already in use

Some advanced technologies are tested in R&D-projects:

- **On-street parking information**
- **In-car applications like**
  - Individual guidance
  - Advanced reservations
  - Electronic in-car payment

Parking Information on Variable Message Boards

- 19 big variable message boards installed at main arterial roads and selected Park+Ride-Lots
- Centrally controlled by traffic management centre
- Messages usually determined by automatic processes

- Records of the year 2000:
  - 25688 messages
  - 23% parking related
  - majority road traffic information
  - minority emergencies or general information

On-Street Parking Information

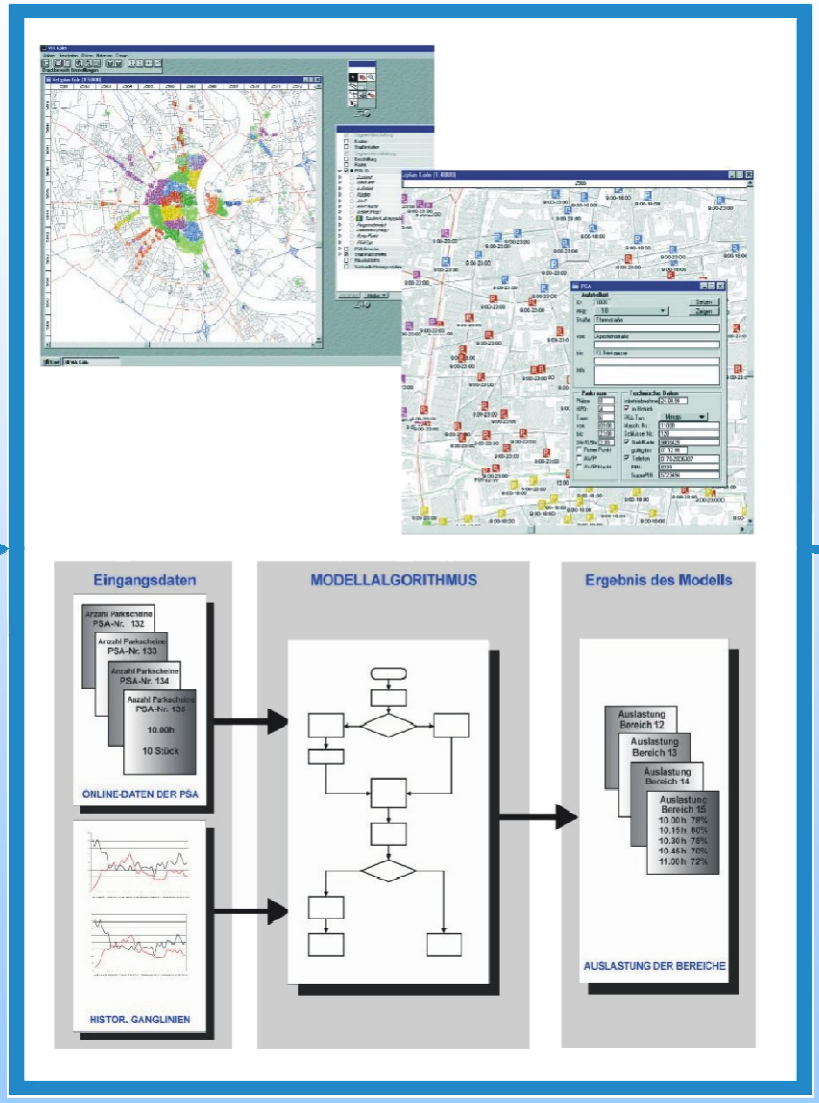
- 27000 metered on-street parking places in city centre
- Usually:
  No information about free capacity available

- Now:
  Link of 980 ticketing machines per GSM with operator center
- Machines provide number of valid tickets every 15 minutes per SMS
- Algorithms determine
  - occupation rate per area
  - forecast for next hour

On-Street Parking Information

Ticket Machines

Ticket Machines Control Center



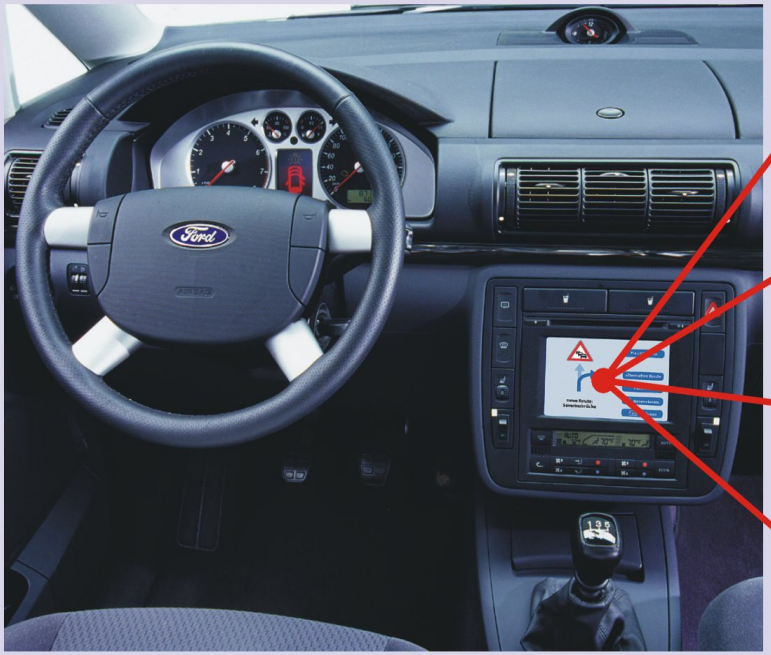
Parking Management Computer

- Visualisation
- Statistics
- Information
  - Processing
  - Distribution
- . . .
- . . .

Input from Parking Guidance System

Example: Presentation of Results on-street parking info

In-car Parking Technologies in Cologne



Information

Guidance

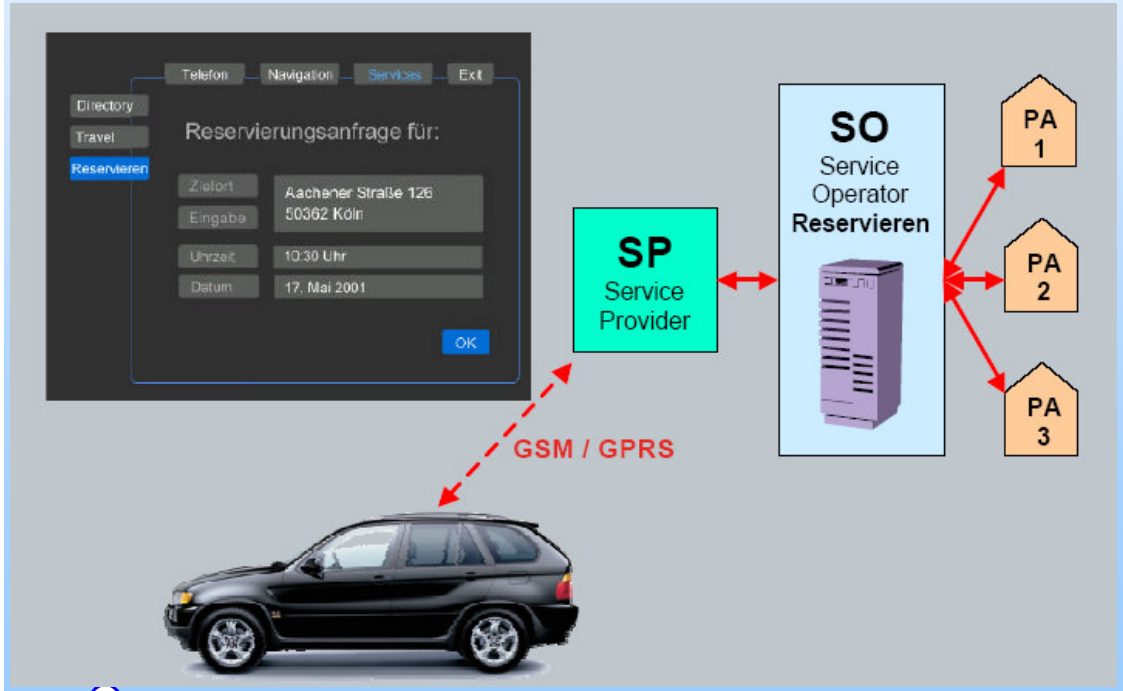
Reservation

Electronic Payment

- Adoption of parking services for in-car systems (internet based technology)
- Link to navigation system

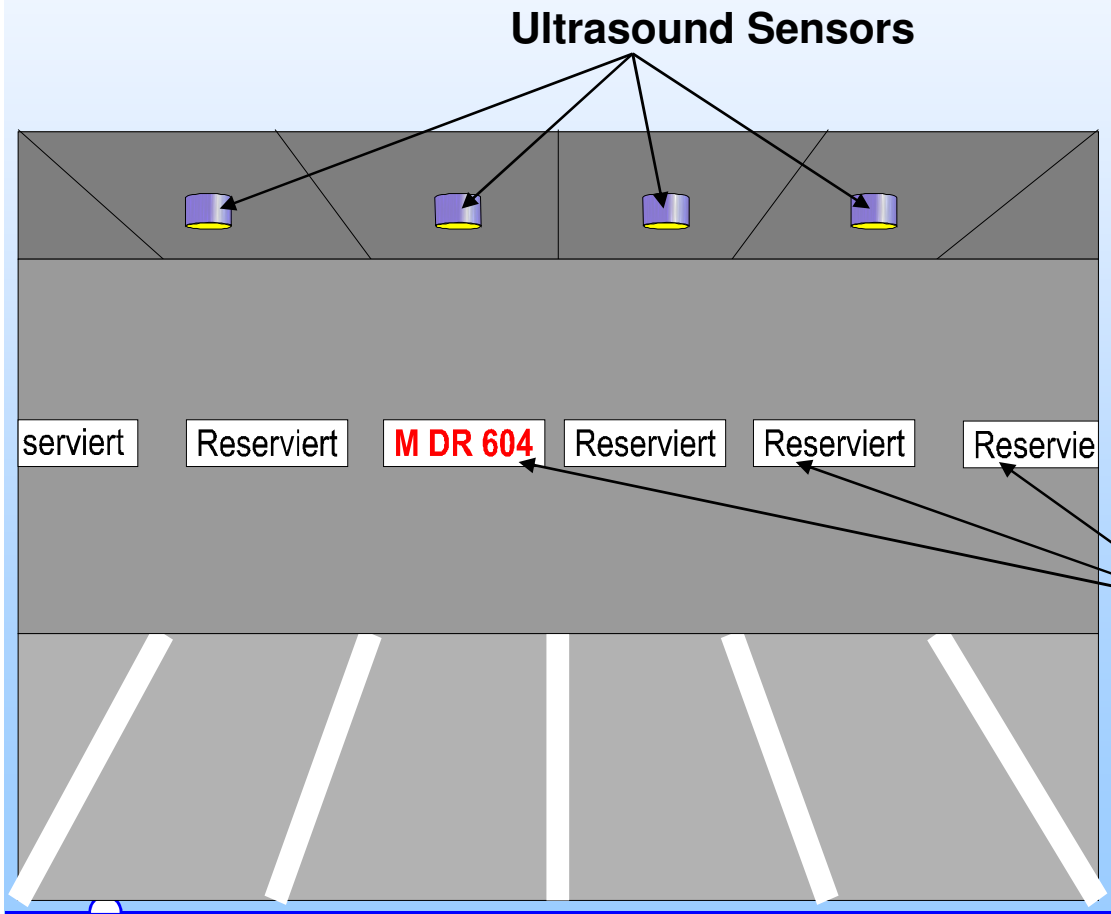
Parking Garage Test Applications:

- space reservation in advance
- car identification
- in-house guidance
- automatic debiting



Parking Space Reservation

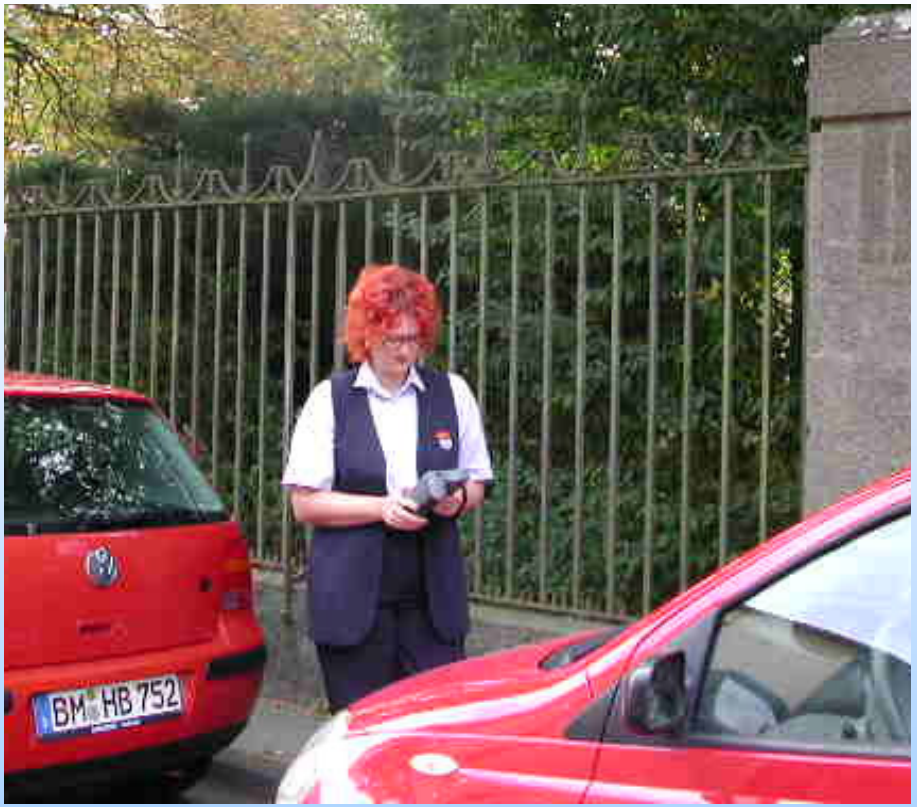
- **Reservation by phone or internet**
- **Dynamic assignment of reserved stall in garage**



Variable LCD-Displays

Supporting Measures in Cologne

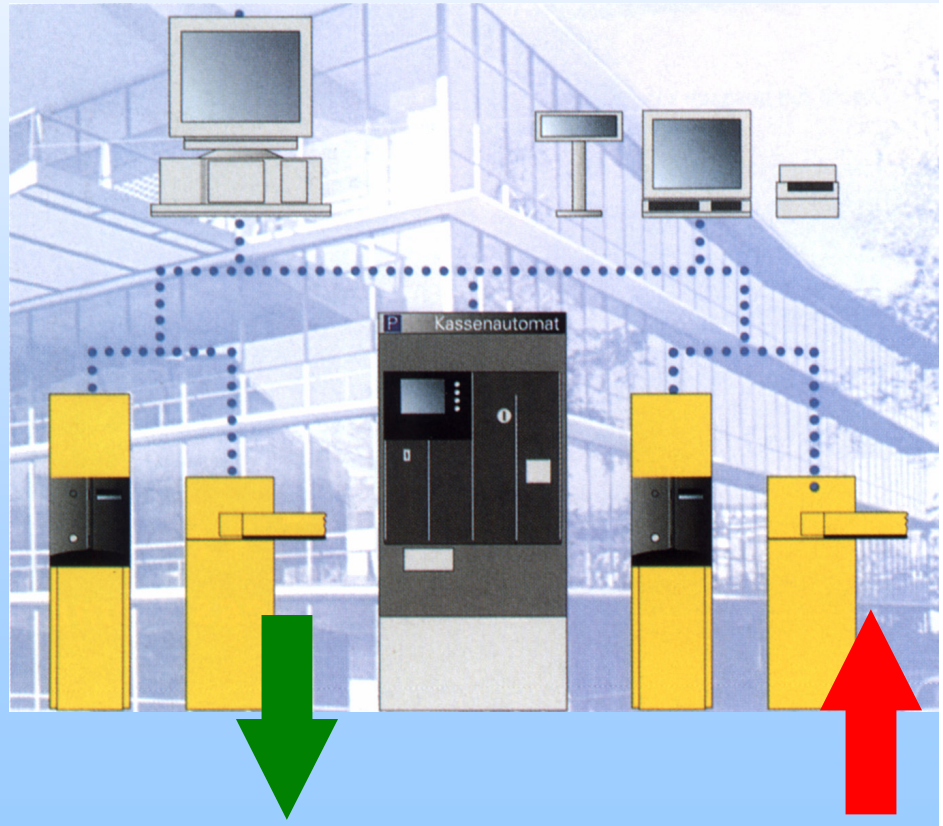
- Consequent parking metering in the city center
- Harmonisation of Parking Fees
  - between garages operated by city and private companies
  - with respect to distance to city center
- Higher parking fees for on-street parking compared to garages
- *Frequent parking enforcement*



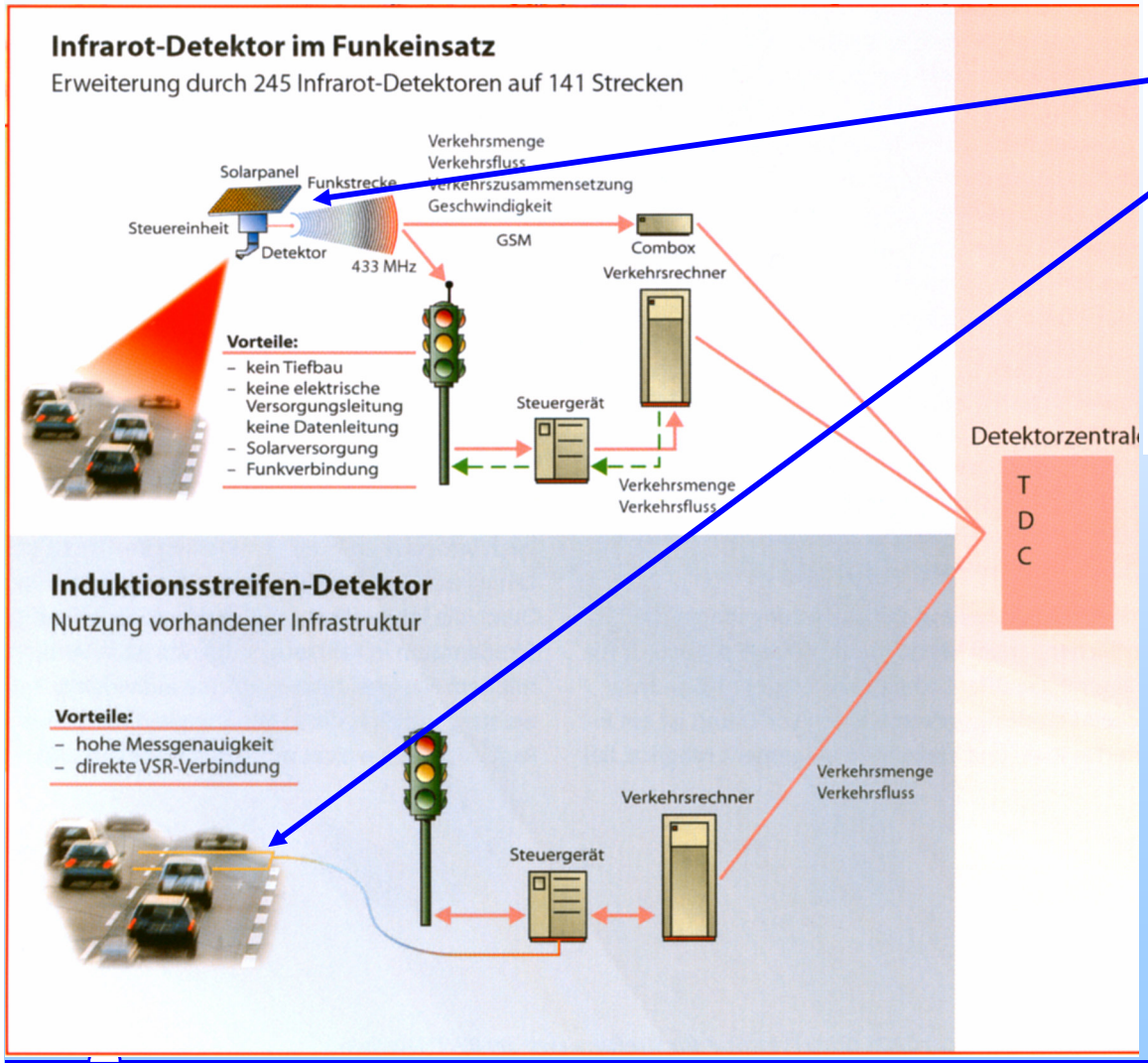
- **Information about location, capacity, equipment etc. of each parking facility**
  => is already on file or can be easily collected

- **Number of actual capacity of each parking facility (available spaces)**

  => derived from difference between inflow and outflow of parking lot:
  Σ cars(in) minus Σ cars(out) = number cars in



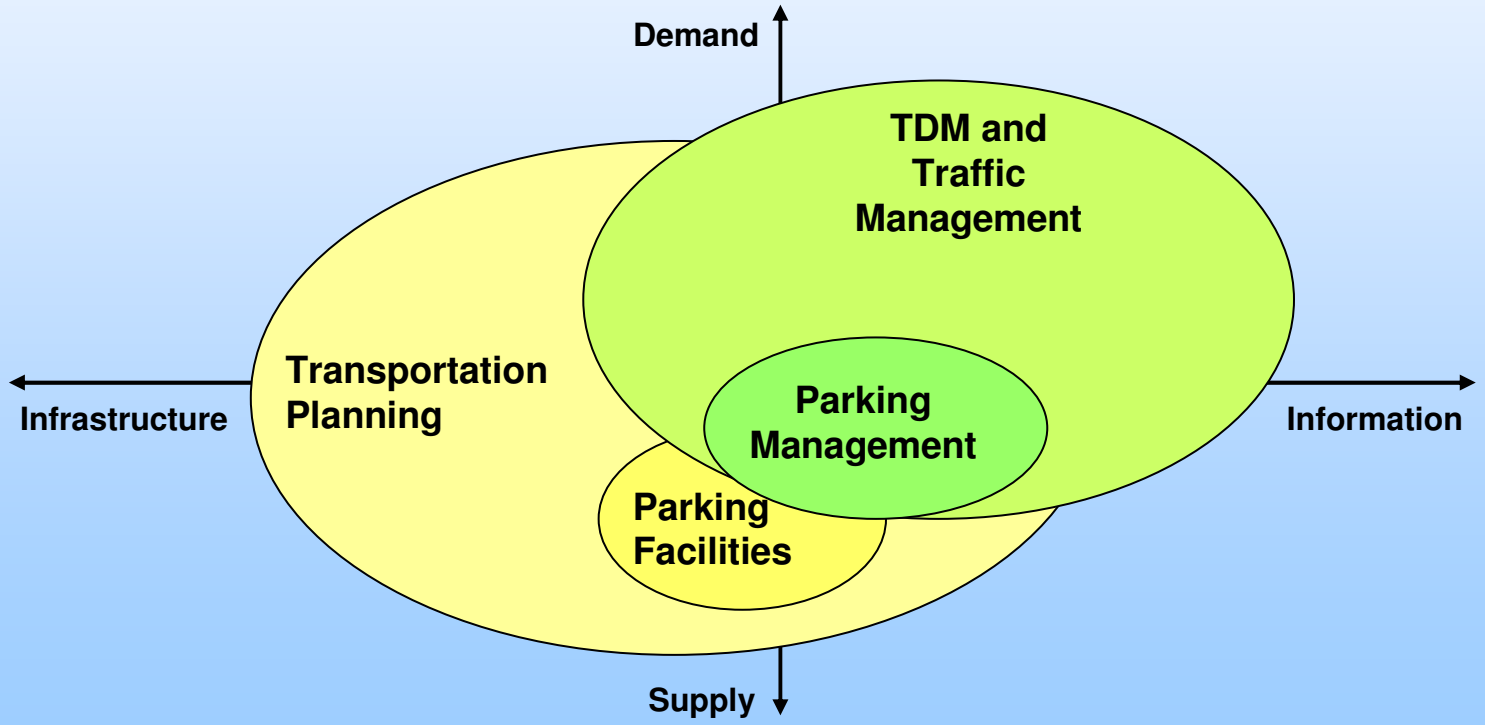
Different methods to count cars



- Gates in parking lots
- Infrared detectors
- Inductive loop detectors
- Video detectors
- Ultrasound detectors

- Reduction of search for parking traffic (e.g. parking guidance systems)
  => reduction of emissions, fuel consumption, time losses
  => increase in productivity
- Better use of existing capacities (e.g. awareness about alternative locations)
- Faster parking processes (e.g. no cruising, advanced payment procedures)
- User friendlier systems (e.g. better information, reservation)

- **Parking Management is always part of an integrated transportation planning process and should be treated in conjunction with an overall TDM and Traffic Management**



Advanced Technologies for Parking Management

Thanks for your attention

Contact

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